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ALGAL NUTRIENT AVAILABILITY AND LIMITATION IN LAKE ONTARIO DURING IFYGL

Appendices to

Part I. Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters

by

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16. ABSTRACT

Samples of Madison urban runoff, precipitation from Madison and New York State were analyzed for various forms of phosphorus to estimate the algal-available fraction of each of these P forms. Urban runoff particulate P forms from Madison runoff showed acid extractable inorganic P in the range of 33 to 46% of the particulate P. Ranges for the OH and for exchange resin extractable inorganic P were 22 to 27 and 13 to 17% of particulate P, respectively. Runoff from urban areas in the Genesee R. basin (N.Y.) showed acid, base, and resin extractable inorganic P in the ranges of 30 to 48, 18 to 30, and 11 to 25% of particulate P, respectively, in general agreement with the Madison samples. Inorganic P extracted from particulate P by resin in long-term aerobic dark incubations was similar to that extracted by the resin in short-term tests, indicating that physical and chemical rather than microbial mineralization processes were probably the key factors regulating the release of inorganic P from the runoff particles to the solution phase.

This portion of the report includes the appendices for Part I of this study, published as EPA-600/3-76-094a. Appendices in this section include (1) statistical formulae and other special calculations, (b) bioassays of soluble and particulate phosphorus with S. capricornutum, (3) dark incubations of unfiltered runoff and river water samples, and (4) chloroform treatment of New York river water.

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APPENDIX A

STATISTICAL FORMULAE AND OTHER SPECIAL CALCULATIONS

1. Arithmetic mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

2. Variance

$$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i^2\right)^2}{n(n-1)}$$

3. Standard deviation

$$s = \sqrt{s^2}$$

4. Coefficient of variation

$$cv = \frac{s}{\bar{x}} \cdot 100\%$$

5. Comparison of two mean values for significant difference (Miller and Freund, 1965) *

$\bar{x}_1$ = mean of n_1 observations

$\bar{x}_2$ = mean of n_2 observations

and $\bar{x}_1 > \bar{x}_2$; let $\bar{x}_1 - \bar{x}_2 = \delta$ with null hypothesis $\delta = 0$

and one-sided alternative hypothesis $\delta > 0$

Compute $$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}}$$

where $$s_{\bar{x}_1 - \bar{x}_2} = \sqrt{(n_1-1)s_1^2 + (n_2-1)s_2^2} \cdot \sqrt{\frac{n_1 + n_2}{n_1 n_2 (n_1+n_2-2)}}$$

Compare t and $t_{.05}$, where $t_{.05}$ is taken from a table of

* Miller, I., and Freund, J.E. Probability and Statistics for Engineers, Prentice-Hall, Inc., Englewood Cliffs, N.J., 432 p. (1965).

t values, entered at $n_1 + n_2 - 2$ degrees of freedom. If $t > t_{.05}$, the difference, $\delta = \bar{x}_1 - \bar{x}_2$ is judged significant at the 95% confidence level.

6. Coefficient of variation for PP calculated by difference (TP-TSP)

   s_1^2 = variance of 3 TP replicate determinations with mean $\bar{x}_1$

   s_2^2 = variance of 3 TSP replicate determinations with mean $\bar{x}_2$

   $PP = \bar{x}_1 - \bar{x}_2$

   $s_{PP} = s_{\bar{x}_1 - \bar{x}_2} = \sqrt{2s_1^2 + 2s_2^2} \cdot \sqrt{\frac{6}{9(4)}}$

   $cv = \frac{s_{PP}}{PP} \cdot 100\%$

7. Least-squares estimators, a and b, of α and β in the linear regression equation $y = \alpha + \beta x$ (Miller and Freund, 1965)

   Normal equations: (n = no. of x,y pairs observed)

   $$\sum_{i=1}^{n} y_i = an + b \sum_{i=1}^{n} x_i$$

   $$\sum_{i=1}^{n} x_i y_i = a \sum_{i=1}^{n} x_i + b \sum_{i=1}^{n} x_i^2$$

8. Sample correlation coefficient (Miller and Freund, 1965)

   $$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}}, \text{ where } S_{xx} = n \sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2$$

   $$S_{yy} = n \sum_{i=1}^{n} y_i^2 - \left(\sum_{i=1}^{n} y_i\right)^2$$

   $$S_{xy} = n \sum_{i=1}^{n} x_i y_i - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)$$

   $100\, r^2$ = percent of the variation of y which is explained by differences in x

9. Calculation of phosphorus available to anion-exchange resin

$$\begin{bmatrix}\text{Available P}\\ \text{conc. in}\\ \text{test flask}\end{bmatrix}^{*} = \frac{\mu gP/l \text{ in 100 ml } Na_2SO_4 \text{ resin leachate}}{\text{percent recovery of P from resin/100}} + \begin{matrix}\text{DRP in flask}\\ \text{supernate}\\ (\mu gP/l)\end{matrix}$$

(see Figure 6.2)

10. Smallest detectable available P concentration in an algal growth bioassay

Compute C = a constant with units of cells/ml or Absorbance at 750 nm:

$$C = \bar{x}_{blank} + t_{.05} \cdot s_{blank}$$

where $t_{.05}$ is found from a table of t values, entered at n-i degrees of freedom, for a one-sided t statistic at the 95% confidence level ($\bar{x}_{blank}$ is the mean value of cultures grown with AAP(-P) medium, and s_{blank} is the corresponding standard deviation of these cultures). The smallest detectable P concentration is the P concentration corresponding to C on the standard curve of growth vs. P concentration.

11. Critical values for rejection of outliers in algal growth bioassays (EPA, 1971)

Rank order all observations: $x_1 < x_2 < x_3 < \ldots x_n$

If x_n is a suspected outlier, compute the criterion $c = \frac{x_n - x_{n-1}}{x_n - x_1}$

Reject x_n if c exceeds the appropriate critical value listed below:

n	critical value at 95% confidence level
3	0.941
4	0.765
5	0.642
6	0.560
7	0.507

* Test flask volumes were 100 ml.

APPENDIX B

BIOASSAYS OF SOLUBLE AND PARTICULATE PHOSPHORUS WITH S. CAPRICORNUTUM

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Table B.1. BIOASSAY OF RUNOFF PARTICLES IN AAP-P MEDIUM

Assay Begun January 9, 1973

A. Standard Curve (all cultures counted after 22 days)

DRP (µgP/l)	Selenastrum, cells/ml ($X10^{-4}$)
0	3
25	47
50	128
100	269

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	Available P mean value (µgP/l)
A-8	1	157	63	
	2	153	62	
	3	146	59	
	4	139	57	60
B-8	1	82	36	
	2	84	36	
	3	100	42	
	4	92	40	
	5	65	29	37
D-8	1	112	46	
	2	105	44	
	3	104	44	
	4	87	38	
	5	101	43	43
502-1	1	18	8	
	2	39	17	
	3	15	6	
	4	19	9	10

Table B.2. COMPUTATION OF PARTICULATE P CONCENTRATIONS IN CULTURE FLASKS

Assay Begun January 9, 1973

Runoff Sample	Sample TP	Sample TSP[a]	Mean sample TP-TSP		ml sample filtered/ml AAP(-P) medium		Culture dilution factor		PP in culture flasks
	(µgP/l)								(µgP/l)
A-8	595	375							
	578	375							
	594	367							
mean value	589	372	217	X	100/100	X	25/27	=	201
B-8	690	414							
	705	412							
	702	425							
mean value	699	417	282	X	50/100	X	25/27	=	130
D-8	680	351							
	712	354							
	695	364							
mean value	696	356	340	X	50/100	X	25/27	=	157
502-1	59	35							
	63	36							
	59	35							
mean value	60	35	25	X	200/100	X	25/27	=	46

[a] Determined on filtrates taken at the time of filtration for collecting sample particles on membrane filters.

Table B.3 BIOASSAY OF RUNOFF PARTICLES IN 3X AAP-P MEDIUM

Assay Begun January 17, 1973

A. Standard Curve[a] (all cultures grown 20 days)

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	0
25	35
50	90
100	247
200	446

B. Sample Flasks[b]

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
A-9	1	132	62	
	2	112	55	
	3	143	66	
	4	131	62	185
	5	175	77	185
	6	152	70	185
		Mean value	65	185
B-9	1	82	44	
	2	75	42	
	3	72	41	
	4	53	34	92
	5	51	33	99
	6	73	41	100
		Mean value	39	97
F-9	1	123	59	
	2	103	51	
	3	88	47	
	4	114	55	95
	5	96	49	92
	6	95	48	94
		Mean value	52	94

[a] 25 ml 3X AAP-P medium + one ml cells + one ml (27X) DRP spike; values are average of 6 flasks.

[b] Particles from runoff samples in 25 ml 3X AAP-P medium + one ml cells + one ml water

Table B.4. BIOASSAY OF RUNOFF PARTICLES IN AAP-P MEDIUM

Assay Begun February 2, 1973

A. Standard Curve (all cultures grown 19 days)

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	7
25	64
50	120
100	248
200	499

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
D-11	1	143	58	
	2	137	56	
	3	124	50	206
	4	112	46	213
	5	88	37	209
		Mean value	49	209
E-11	1	51	28	
	2	41	18	
	3	46	21	254
	4	45	20	259
	5	28	12	250
		Mean value	19	254
H-11	1	357	143	
	2	345	138	467
	3	341	137	458
	4	370	149	481
		Mean value	142	469

Table B.5. BIOASSAY OF RUNOFF PARTICLES IN AAP-P MEDIUM

Assay Begun March 7, 1973

A. Standard Curve (all cultures grown 20 days)

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	8
25	64
50	126
100	254
200	516

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
A-12	1	215	84	
	2	238	93	
	3	203	79	189
	4	206	81	176
	5	162	63	173
		Mean value	80	179
B-12	1	167	65	
	2	168	66	
	3	137	53	186
	4	138	54	189
	5	151	59	192
		Mean value	59	189
D-12	1	74	30	
	2	85	34	
	3	81	32	118
	4	71	28	120
	5	79	31	125
		Mean value	31	121
I-12	1	141	55	
	2	129	50	
	3	153	60	359
	4	152	59	347
	5	163	64	361
		Mean value	58	365

Table B.6. BIOASSAY OF SOLUBLE PHOSPHORUS IN URBAN RUNOFF

Assay Begun January 6, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.015
25	0.079
50	0.142
100	0.217

B. Sample Flasks[a]

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	Chemical analyses: DRP in Cultures (µgP/l)	Chemical analyses: TSP in Cultures (µgP/l)
A-8	1	0,199	83		
	2	0.170	64		
	3	0.178	70		
	4	0.190	77		
	5	0.185	73		
		Mean value	73	66	68
B-8	1	0.210	93		
	2	0.203	86		
	3	0.210	93		
	4	0.191	77		
	5	0.190	77		
		Mean value	85	76	81
D-8	1	0.170	64		
	2	0.185	74		
	3	0.195	80		
	4	0.190	77		
	5	0.185	73		
		Mean value	74	61	65

[a]Five ml of filtered runoff and 20 ml (5/4X) AAP-P + one ml cells + one ml water; cultures spiked with 1X nitrate (AAP) after 6 days

Table B.7. BIOASSAY OF SOLUBLE PHOSPHORUS IN URBAN RUNOFF

Assay Begun January 19, 1973

A. Standard Curve

DRP (µgP/l	Absorbance (750 nm)
0	0.007
50	0.118
100	0.215
150	0.289
200	0.361

B. Sample Flasks[a]

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	Chemical Analyses: DRP in Cultures (µgP/l)	Chemical Analyses: TSP in Cultures (µgP/l)
A-9	1	0.495			
	2	0.470			
	3	0.480	All > 200	161	181
	4	0.499			
	5	0.460			
B-9	1	0.460			
	2	0.460			
	3	0.460	All > 200	150	167
	4	0.450			
	5	0.455			
F-9	1	0.269	133		
	2	0.281	141		
	3	0.290	148		
	4	0.272	135		
	5	0.275	137		
		Mean value	139	90	102

[a]Five ml of filtered runoff sample + 20 ml (5/4X AAP-P) medium + one ml water + one ml cells.

Table B.8. BIOASSAY OF SOLUBLE PHOSPHORUS IN URBAN RUNOFF

Assay Begun March 6, 1973

(See assay of January 19)

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.017
100	0.166
200	0.328
300	0.432
400	0.509

B. Sample Flasks[a]

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	Chemical analysis: TSP in Culture Flask (µgP/l)
B-9	1	0.455	327	
	2	0.465	342	
	3	0.475	355	
	4	0.470	348	
	5	0.465	342	
		mean value	343	167
B-9 + 50 µgP/l	1	0.500	391	
	2	0.530	> 400	
	3	0.522	> 400	
	4	0.525	> 400	
	5	0.510	> 400	
		mean value	> 398	217
B-9 + 100 µ gP/l	1	0.525	> 400	
	2	0.535	> 400	
	3	0.535	> 400	
	4	0.540	> 400	
	5	0.548	> 400	267

[a]Five ml of same sample as used in Jan. 19, 1973 assay, + 20 ml (5/4X) AAP-P medium + one ml cells + one ml water + one ml water or DRP (27X) spike

Table B.9. BIOASSAY OF SOLUBLE PHOSPHORUS IN URBAN RUNOFF

Assay Begun February 9, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.010
25	0.070
50	0.116
100	0.206
200	0.365

B. Sample Flasks[a]

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	DRP in Cultures (µgP/l)	TSP in Cultures (µgP/l)
D-10	1	0.127	59	45	50
	2	0.125	58		
	3	0.121	56		
	4	0.120	56		
	5	0.125	58		
		mean value	57		
E-10	1	0.020	4	24	30
	2	0.023	5		
	3	0.025	5		
	4	0.025	5		
	5	0.025	5		
		mean value	5		
H-10	1	0.113	52	81	98
	2	0.091	41		
	3	0.101	46		
	4	0.100	45		
	5	0.103	47		
		mean value	46		
D-11	1	0.090	40	47	48
	2	0.111	50		
	3	0.105	48		
	4	0.103	47		
	5	0.105	48		
		mean value	47		

Table B.9. (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	DRP in Cultures (µgP/l)	TSP in Cultures (µgP/l)
E-11	1	0.034	10	22	25
	2	0.023	4		
	3	0.029	8		
	4	0.030	8		
	5	0.022	4		
		mean value	7		
H-11	1	0.040	13	20	21
	2	0.041	14		
	3	0.032	8		
	4	0.045	16		
	5	0.035	11		
		mean value	12		

[a]Samples D-10, D-11, H-11: five ml filtered runoff + 20 ml (5/4X) AAP(-P) medium + one ml cells + one ml of water
Samples E-10, H-10, E-11: 20 ml filtered runoff + five ml (5X) AAP(-P) medium + one ml cells + one ml water

Table B.10. BIOASSAY OF SOLUBLE PHOSPHORUS IN URBAN RUNOFF

Assay Begun March 13, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.010
25	0.042
50	0.081
100	0.141

B. Sample Flasks[a]

Sample--flask[a]		Absorbance (750 nm)	Available P (µgP/l)	DRP in Cultures (µgP/l)	TSP in Cultures (µgP/l)
A-12	1	0.121	85	49	51
	2	0.099	68		
	3	0.135	95		
	4	0.122	85		
	5	0.122	85		
		mean value	84		
B-12	1	0.165	120	64	65
	2	0.160	115		
	3	0.161	116		
	4	0.160	115		
		Mean value	116		
D-12	1	0.110	76	46	48
	2	0.110	76		
	3	0.096	65		
	4	0.108	74		
	5	0.092	62		
		mean value	71		
I-12	1	0.029	14	22	34
	2	0.028	13		
	3	0.025	11		
	4	0.028	13		
	5	0.025	11		
		mean value	12		

[a]Samples A-12, B-12, D-12: five ml filtered runoff + 20 ml (5/4X) AAP(-P) medium + one ml cells + one ml water. Sample I-12: 20 ml filtered runoff + five ml (5X) AAP(-P) medium + one ml cells + one ml water

Table B.11. BIOASSAY OF PARTICLES FROM MADISON SNOW SAMPLES

Assay Begun April 27, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	9
10	26
25	62
50	167
100	305
200	647

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
Snow	1	48	20	
Picnic Pt.	2	29	11	
	3	33	12	
	4	31	12	82
	5	41	17	83
		Mean value	14	82
Snow	1	1	< 2	
Roof of	2	0	< 2	
City-County	3	1	< 2	
Bldg.	4	2	< 2	118
	5	2	< 2	118
		Mean value	< 2	118
Snow	1	86	35	
Near Meat	2	68	27	
Packing	3	64	26	135
Plant	4	77	31	127
		Mean value	30	131

Table B.12. BIOASSAY OF PHOSPHORUS IN UNFILTERED NEW YORK RAIN GAGE SAMPLES

Assay Begun July 16, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	10
10	38
25	86
50	154

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	TP in Cultures (µgP/l)
May 601	1	111	35	
	2	88	27	
	3	102	32	307
	4	93	29	315
	5	102	32	312
		mean value	31	311
May 602	1	22	4	
	2	19	3	
	3	18	3	62
	4	18	3	64
	5	17	3	65
		mean value	3	64
May 606	1	6	< 2	
	2	5	< 2	
	3	6	< 2	327
	4	6	< 2	330
	5	4	< 2	319
		mean value	< 2	325
June 601	1	78	24	
	2	98	31	
	3	96	30	53
	4	98	31	53
	5	103	32	53
		mean value	31	53

Table B.12. (continued)

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	TP in Cultures (µgP/l)
June 603	1	14	2	
	2	19	3	
	3	18	3	77
	4	22	4	74
	5	19	3	84
		mean value	3	78
June 604	1	117	37	
	2	172	56	
	3	137	44	47
	4	114	36	49
	5	124	40	47
		mean value	43	48

The following samples were quantitated by comparison of their Absorbance at 750 nm (A_{750}), compared to the mean A_{750} of the 10 µgP/l standard = 0.035:

Sample	Average A_{750}	Approximate Available P (µgP/l)	Average TP in Cultures (µgP/l)
May 603	0.009	< 10	3
May 604	0.011	< 10	4
May 605	0.025	< 10	259
June 602	0.011	< 10	7
June 605	0.012	< 10	7
June 606	0.012	< 10	9
June 608	0.017	< 10	256

Table B.13. BIOASSAY OF RUNOFF PARTICLES IN AAP-P MEDIUM

Assay Begun December 21, 1973

A. Standard Curve[a]

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	≤ 1
25	65
50	118
100	193

B. Sample Flasks[b]

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
502-1	1	29	10	
	2	10	3	
	3	12	4	
	4	24	8	
	5	38	14	40
	6	36	13	44
				44
		mean value	9	43

[a] 25 ml AAP-P + one ml cells + one ml DRP (27X) spike (27 ml volume); values are averages of six flasks

[b] Particles from sample 502-1 in 25 ml AAP-P medium + one ml cells (26 ml volume)

Table B.14. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun March 29, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.010
25	0.050
50	0.090
100	0.180
200	0.339

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 27	1	0.010	< 1	
	2	0.010	< 1	
	3	0.010	< 1	
	4	0.010	< 1	4
	5	0.010	< 1	5
		mean value	< 1	4
No. 28	1	0.119	68	
	2	0.115	64	
	3	0.110	60	
	4	0.121	68	47
	5	0.111	60	47
		mean value	64	47
No. 29	1	0.165	95	
	2	0.149	85	
	3	0.155	88	
	4	0.160	91	56
	5	0.178	102	56
		mean value	92	56

Table B.15. BIOASSAY OF 507-7 PARTICLES IN AAP (-P) MEDIUM

Assay Begun March 29, 1973

Sample--Flask		Selenastrum* Cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
507-7	1	0	0	
	2	0	0	
	3	0	0	62
	4	0	0	62
	5	0	0	58
		mean value	0	61

* No cell counts were made for standards since the growth in the samples was negligible.

Table B.16. BIOASSAY OF PARTICLES FROM NEW YORK RIVER WATERS AND GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun April 14, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	1
25	64
50	107
100	227
200	572

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
				124
No. 34	1	8	3	123
	2	6	2	116
	3	9	4	108
	4	11	5	118
	5	6	2	126
		mean value	3	119
No.	1	76	33	
502-7	2	70	31	
	3	79	35	142
	4	56	25	140
	5	53	24	128
		mean value	30	137
No.	1	30	13	
502-8	2	43	19	
	3	56	25	99
	4	53	23	99
	5	52	23	103
		mean value	21	100

Table B.16. (continued)

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No.	1	9	4	
504-8	2	9	4	
	3	9	4	57
	4	12	5	55
	5	7	3	60
		mean value	4	57
No.	1	4	1	
507-8	2	7	3	
	3	10	4	68
	4	6	2	65
	5	5	2	59
		mean value	2	64

Table B.17. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun April 14, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.000
25	0.052
50	0.071
100	0.131
200	0.228

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 31	1	0.055	40	
	2	0.058	42	30
	3	0.053	38	28
	4	0.055	40	31
		mean value	40	30
No. 32	1	0.004	1	
	2	0.004	1	
	3	0.004	1	
	4	0.004	1	6
	5	0.004	1	6
		mean value	1	6
No. 33	1	0.010	5	
	2	0.010	5	
	3	0.012	7	
	4	0.011	5	10
	5	0.010	5	10
		mean value	5	10

Table B.17 (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 34	1	0.047	32	
	2	0.046	32	
	3	0.042	30	30
	4	0.047	32	30
	5	0.045	31	29
		mean value	31	30
No. 35	1	0.125	95	
	2	0.113	85	
	3	0.120	90	53
	4	0.122	92	52
	5	0.129	100	53
		mean value	92	53
No. 36	1	0.013	7	
	2	0.010	5	
	3	0.019	12	14
	4	0.018	11	16
	5	0.019	12	14
		mean value	9	15

Table B.18. BIOASSAY OF PARTICLES FROM NEW YORK RIVER AND GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun May 8, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	10
25	77
50	157
100	323
200	625

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 42	1	56	18	
	2	83	27	
	3	34	10	187
	4	9	< 2	190
	5	1	< 2	185
		mean value	< 12	187
No. 43	1	4	< 2	
	2	5	< 2	
	3	0	< 2	
	4	0	< 2	306
	5	0	< 2	308
		mean value	< 2	309
No. 44	1	17	3	
	2	22	5	137
	3	18	3	128
	4	23	5	133
		mean value	4	133

Table B.18 (continued)

Sample--Flask		Selenastrum cells/ml ($\times 10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No.	1	236	73	
502-10	2	282	87	
	3	372	114	333
	4	93	29	320
	5	299	92	331
		mean value	79	328
No.	1	5	< 3	
507-12	2	0	< 3	
	3	1	< 3	207
	4	0	< 3	204
	5	0	< 3	218
		mean value	< 3	210

Table B.19. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun May 8, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)
0	0.010
25	0.046
50	0.092
100	0.183
200	0.281

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 40	1	0.010	< 1	
	2	0.010	< 1	
	3	0.010	< 1	
	4	0.011	< 1	5
	5	0.010	< 1	3
		mean value	< 1	4
No. 41	1	0.010	< 1	
	2	0.010	< 1	
	3	0.010	< 1	
	4	0.010	< 1	5
	5	0.010	< 1	4
		mean value	< 1	4
No. 42	1	0.060	31	
	2	0.055	28	
	3	0.060	31	
	4	0.062	32	32
	5	0.055	28	32
		mean value	30	32

Table B.19. (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 43	1	0.079	42	
	2	0.079	42	
	3	0.087	48	
	4	0.078	42	39
	5	0.060	32	39
		mean value	41	39

Table B.20. BIOASSAY OF PARTICLES FROM NEW YORK RIVER AND GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun May 22, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	5
10	29
25	87
100	347

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 47	1	25	8	
	2	16	5	
	3	14	4	239
	4	21	6	230
	5	4	< 2	238
		mean value	< 5	236
No. 502-11	1	2	< 2	164
	2	2	< 2	164
	3	2	< 2	164
	4	1	< 2	164
		mean value	< 2	164
No. 507-11	1	5	< 2	
	2	4	< 2	
	3	3	< 2	70
	4	5	< 2	68
	5	5	< 2	66
		mean value	< 2	68

Table B.21. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun May 22, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)	Selenastrum cells/ml ($X10^{-4}$)
0	0.009	5
10	0.031	29
25	0.075	87
50	0.098	--
100	0.209	341
200	0.308	--
300	0.395	--
400	0.423	--

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 47	1	0.125	61	
	2	0.125	61	
	3	0.128	63	56
	4	0.122	60	53
	5	0.130	67	51
		mean value	61	53

C. Comparison: quantitation by cell counting

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 47	1	140	40	
	2	141	41	
	3	138	40	
	4	139	40	
	5	147	42	
		mean value	41	53

Table B.22. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun May 31, 1973

A. Standard Curve

DRP (µgP/l)	(A) Absorbance (750 nm)	(S) Selenastrum cells/ml (X10^{-4})	DRP (µgP/l)	(A)	(S)
0	0.008	6	400	0.404	1169
10	0.026	28	500	0.437	1241
25	0.053	74	600	0.459	1365
50	0.097	163			
100	0.186	323			
200	0.301	742			
300	0.363	1002			

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 49	1	0.011	< 3	
	2	0.011	< 3	
	3	0.010	< 3	12
	4	0.010	< 3	13
	5	0.010	< 3	11
		mean value	< 3	12
No. 50	1	0.010	< 3	
	2	0.010	< 3	
	3	0.010	< 3	13
	4	0.011	< 3	10
	5	0.010	< 3	12
		mean value	< 3	12
No. 51	1	0.229	126	
	2	0.242	137	
	3	0.261	150	84
	4	0.219	120	85
	5	0.274	163	82
		mean value	139	83

Table B.22. (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 52	1	0.130	68	
	2	0.137	71	52
	3	0.132	69	58
	4	0.133	69	53
		mean value	69	54
No. 53	1	0.031	12	
	2	0.045	21	
	3	0.039	16	28
	4	0.040	17	27
	5	0.041	18	27
		mean value	17	27

C. Comparison: quantitation by cell counting

Sample--Flask		Selenastrum cells/ml ($\times 10^{-4}$)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 51	1	300	92	
	2	302	92	
	3	296	90	
	4	310	94	
		mean value	92	83
No. 52	1	151	50	
	2	156	51	
	3	150	50	
	4	154	51	
		mean value	50	54

Table B.23. BIOASSAY OF PARTICLES FROM NEW YORK RIVER AND GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun May 31, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml (X10^{-4})	DRP (µgP/l)	Selenastrum cells/ml (X10^{-4})
0	6	400	1169
10	28	500	1241
25	74	600	1365
50	163		
100	323		
200	742		
300	1002		

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml (X10^{-4})	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 50	1	15	4	
	2	23	7	
	3	1	< 3	79
	4	18	5	78
	5	11	< 3	79
		mean value	< 4	79
No. 50 (auto-claved)	1	138	46	
	2	131	43	
	3	138	46	
	4	122	41	
	5	156	51	
		mean value	45	79
No. 50 + 50 µgP/l (auto-claved)	1	287	88	
	2	251	78	
	3	266	82	
	4	278	85	
		mean value	83	

Table B.23. (continued)

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 51	1	9	< 3	
	2	11	< 3	117
	3	2	< 3	116
	4	1	< 3	112
		mean value	< 3	115
No. 51	1	159	52	
	2	155	51	
	3	136	45	
	4	131	43	
	5	132	44	
		mean value	47	115
No. 51 + 50 µgP/l (auto-claved)	1	299	91	
	2	307	93	
	3	279	85	
		mean value	90	
No. 52	1	4	< 3	
	2	2	< 3	
	3	2	< 3	135
	4	0	< 3	137
	5	0	< 3	150
		mean value	< 3	141
No. 52 (auto-claved)	1	169	55	
	2	204	65	
	3	217	69	
	4	202	65	
	5	160	55	
		mean value	62	141
No. 53	1	0	< 3	
	2	4	< 3	
	3	0	< 3	65
	4	1	< 3	69
	5	1	< 3	65
		mean value	< 3	66

Table B. 23 (continued)

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 53 (auto-claved)	1	71	24	
	2	92	31	
	3	107	36	
	4	61	20	
	5	110	37	
		mean value	30	66

Table B.24. BIOASSAY OF PARTICLES FROM GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun June 5, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	5
10	29
25	73
50	173
100	329
200	639
300	994

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No.501-12[a]	1	19	5	
	2	4	< 2	
	3	12	3	147
	4	16	4	136
	5	15	4	155
		mean value	< 4	146
No.502-12	1	4	< 2	
	2	32	9	
	3	19	5	79
	4	35	10	78
	5	19	5	85
		mean value	< 6	81

[a]Inoculated on June 6, 1967, with same cell suspension used on standards and sample No.502-12 on June 5, 1973.

Table B.25. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun June 5, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)	Selenastrum cells/ml ($X10^{-4}$)
0	0.010	5
10	0.027	29
25	0.056	73
50	0.098	173
100	0.202	329
200	0.302	639
300	0.381	994

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 52[a]	1	0.152	77	
	2	0.150	76	
	3	0.149	75	52
	4	0.145	73	58
	5	0.159	81	53
		mean value	76	54
No. 52 +	1	0.230	125	
25 µgP/l	2	0.205	130	
	3	0.238	131	
	4	0.235	129	
	5	0.227	123	
		mean value	127	79
No. 52 +	1	0.280	171	
50 µgP/l	2	0.290	182	
	3	0.280	171	
	4	0.240	132	
	5	0.255	147	
		mean value	161	104

[a] 20 ml of sample No. 52 + one ml cells + one ml of water or 27X orthophosphate spike; the sample No. 52 used in these tests was the same as used in the bioassay begun May 31, 1973.

Table B.25 (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 52 +	1	0.301	196	
100 µgP/l	2	0.302	197	
	3	0.329	230	
	4	0.342	248	
	5	0.320	220	
		mean value	218	54
No. 52 +	1	0.362	277	
200 µgP/l	2	0.321	221	
	3	0.339	243	
	4	0.345	252	
	5	0.340	245	
		mean value	248	254

C. Comparison: quantitation by counting cells

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 52	1	158	48	
	2	151	46	
	3	171	53	
	4	159	49	
	5	169	52	
		mean value	50	54

Table B.26. BIOASSAY OF PARTICLES FROM NEW YORK RIVER WATERS AND GENESEE RIVER BASIN SAMPLES

Assay Begun June 25, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	2
10	20
25	78
50	172
100	374
200	746

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 56 (autoclaved)	1	86	27	
	2	97	30	
	3	93	29	87
	4	91	28	84
	5	108	33	90
		mean value	29	87
No. 58 (not autoclaved)	1	competing algae present; could not count *S. capricornutum* accurately		
	2			
	3			
	4			
	5			
No. 58 (autoclaved)	1	252	70	
	2	298	82	
	3	385	105	231
	4	380	103	246
	5	235	66	234
		mean value	85	237

Table B.26 (continued)

Sample--Flask		Selenastrum cells/ml ($\times 10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 59 (auto-claved)	1	203	58	
	2	183	52	
	3	191	55	163
	4	158	46	163
	5	170	49	162
		mean value	52	163
No. 60 (auto-claved)	1	160	46	
	2	156	45	
	3	155	45	196
	4	198	57	190
	5	178	51	182
		mean value	49	189
No.501-13 (auto-claved)	1	46	16	
	2	48	17	
	3	49	17	99
	4	49	17	106
	5	50	17	103
		mean value	17	103
No.507-13 (auto-claved)	1	45	16	
	2	56	20	
	3	51	18	221
	4	51	18	225
	5	42	15	225
		mean value	17	224

Table B.27. BIOASSAY OF AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS

Assay Begun June 25, 1973

A. Standard Curve

DRP (µgP/l)	Absorbance (750 nm)	Selenastrum cells/ml ($X10^{-4}$)
0	0.004	2
10	0.025	20
25	0.067	78
50	0.102	172
100	0.225	374
200	0.318	746
300	0.404	-

B. Sample Flasks

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 56	1	0.019	7	
	2	0.018	7	
	3	0.019	7	13
	4	0.020	7	13
		mean value	7	13
No. 56 + 25 µgP/1	1	0.100	43	
	2	0.111	48	
	3	0.109	46	
	4	0.105	45	
	5	0.112	48	
		mean value	46	38
No. 57	1	0.011	3	
	2	0.010	3	
	3	0.015	5	
	4	0.011	3	11
	5	0.010	3	11
		mean value	3	11
No. 57 + 25 µgP/1	1	0.102	43	
	2	0.102	43	
	3	0.101	42	
	4	0.102	43	
	5	0.105	45	
		mean value	43	36

Table B.27. (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 58	1	0.140	60	
	2	0.139	60	
	3	0.138	60	
	4	0.142	62	50
	5	0.140	60	50
		mean value	60	50
No. 58 +	1	0.228	101	
25 µgP/l	2	0.211	93	
	3	0.225	100	
	4	0.235	106	
	5	0.230	102	
		mean value	100	75
No. 59	1	0.152	67	
	2	0.160	70	
	3	0.158	69	57
	4	0.162	72	55
		mean value	70	56
No. 59 +	1	0.241	110	
25 µgP/l	2	0.245	112	
	3	0.240	110	
	4	0.245	112	
	5	0.240	110	
		mean value	111	81
No. 59 (½X)[a]	1	0.080	33	
	2	0.079	33	
	3	0.080	33	
	4	0.078	32	
		mean value	33	28
No. 59 (½X)[a] +	1	0.180	80	
	2	0.187	82	
25 µgP/l	3	0.183	81	
	4	0.185	82	
	5	0.188	83	
		mean value	82	53

[a]Ten ml of sample No. 59 diluted to 20 ml with glass dist. water before assay.

Table B.27. (continued)

Sample--Flask		Absorbance (750 nm)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 60	1	0.065	27	
	2	0.070	29	
	3	0.065	27	38
	4	0.069	28	38
		mean value	28	38
No. 60 +	1	0.169	75	
25 µgP/l	2	0.170	75	
	3	0.170	75	
	4	0.166	73	
	5	0.173	77	
		mean value	75	63

C. Comparison: quantitation by counting cells

Sample--Flask		Selenastrum cells/ml ($X10^{-4}$)	Available P (µgP/l)	TSP in Cultures (µgP/l)
No. 56	1	13	7	
	2	12	7	
	3	15	8	
	4	15	8	
	5	9	5	
		mean value	7	13
No. 56 +	1	101	31	
25 µgP/l	2	114	34	
	3	97	30	
	4	115	34	
	5	106	32	
		mean value	32	38

Recovery of 25 µgP/l spike = 100%

Table B.28. BIOASSAY OF PARTICLES FROM GENESEE R. BASIN SAMPLES IN AAP-P MEDIUM

Assay Begun July 2, 1973

A. Standard Curve

DRP (µgP/l)	Selenastrum cells/ml ($X10^{-4}$)
0	7
10	23
25	94
50	162
100	336

B. Sample Flasks

Sample--Flask		Selenastrum cells/ml (X10-4)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 501-14	1	7	< 2	
	2	17	6	
	3	15	5	50
	4	12	4	54
	5	23	8	53
		mean value	< 5	52
No. 501-14 (auto-claved)	1	38	12	
	2	34	11	
	3	39	12	54
	4	35	11	54
	5	33	10	55
		mean value	11	54
No. 502-14	1	13	4	
	2	1	< 2	
	3	0	< 2	131
	4	0	< 2	126
	5	1	< 2	124
		mean value	< 2	127
No. 502-14 (auto-claved)	1	138	42	
	2	152	45	
	3	160	48	128
	4	146	44	127
	5	143	43	128
		mean value	44	128

Table B.28. (continued)

Sample--Flask		Selenastrum cells/ml ($\times 10^{-4}$)	Available P (µgP/l)	PP in Cultures (µgP/l)
No. 507-14	1	38	12	
	2	30	10	
	3	45	14	440
	4	28	9	458
	5	44	14	434
		mean value	12	444
No. 507-14 (auto-claved)	1	162	48	
	2	179	54	
	3	167	50	479
	4	164	49	505
	5	169	51	459
		mean value	50	481

Table B.29. AVAILABLE P IN AUTOCLAVED NEW YORK RIVER WATERS AS CALCULATED USING CORRECTED NET A_{750} DATA

Sample No.	Net Mean A_{750} in Bioassay	Corrected Net Mean A_{750}[b]	Mean Blank A_{750}	Corrected Net Mean A_{750} + Mean Blank A_{750}	Available In Bioassay Flasks (µgP/l)
		Niagara R. at Ft. Niagara			
27	0.000	0.000	0.010	0.010	< 1
33	0.011	0.008	0.000	0.008	4
41	0.000	0.000	0.010	0.010	< 1
50	0.002	0.001	0.008	0.009	< 3
56	0.015	0.010	0.004	0.014	5
		Niagara R. at Beaver I. Park			
32	0.004	0.003	0.000	0.003	< 1
40	0.000	0.000	0.010	0.010	< 1
49	0.002	0.001	0.008	0.009	< 3
57	0.007	0.005	0.004	0.009	3
		Genesee R.			
34	0.045	0.031	0.000	0.031	22
42	0.048	0.034	0.010	0.044	23
51	0.237	0.166	0.008	0.174	92
58	0.136	0.095	0.004	0.099	42
		Oswego R.			
28	0.105	0.073	0.019	0.083	45
29	0.151	0.106	0.010	0.116	65
31	0.055	0.039	0.000	0.039	27
35	0.122	0.085	0.000	0.085	65
43	0.067	0.047	0.010	0.057	29
47[d]	0.117	0.082	0.009	0.091	42
52[d]	0.125	0.087	0.008	0.095	47
52[e]	0.141	0.099	0.010	0.109	53
59	0.154	0.108	0.004	0.112	48
59(1/2X)	0.075	0.052	0.004	0.056	24

[a] Mean A_{750} of sample cultures minus the mean A_{750} of the blank cultures

[b] Net mean A_{750} divided by 1.43

[c] Found by comparing the corrected net mean A_{750} to a standard curve of A_{750} vs. P concentration for standard AAP cultures

[d] Assayed May 31, 1973

[e] Assayed June 5, 1973

APPENDIX C

DARK INCUBATIONS OF UNFILTERED RUNOFF AND RIVER WATER SAMPLES

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APPENDIX C

DARK INCUBATIONS OF UNFILTERED RUNOFF AND RIVER WATER SAMPLES

Table C.1. Dark Incubation Begun September 26, 1972

A. Initial Period of Storage at 4°C

Sample No.	Initial DRP[a] (µgP/l)	Storage Period (days)
23-Oswego R.	49	35
24-Oswego R. Mouth	41	21
25-Black R.	14	21
26-Oswego R.	79	21
B-4 Madison Runoff	240	7

[a]Determined prior to storage

B. Dark Incubation at 17-23°C (Begun Sept. 26, 1973)

Sample No.	DRP (µgP/l) after incubation[b]			
	Sample		Sample + Resin	
	23 days	50 days	23 days	50 days
23	61	73	65	78
mean	69	71	--	74
values	65	72	--	76
24	61	62	64	53
mean	58	59	--	59
values	60	61	--	56
25	25	31	20	22
mean	21	27	--	30
values	23	29	--	26

Table C.1. (continued)

26	112	120	95	114
mean	110	109	--	103
values	111	114	--	108
B-4	274	244	321	322
mean	248	240	--	315
values	261	242	--	318

[b] All samples except B-4 were filtered through glass fiber filters for DRP determined during the incubations; B-4 was filtered through 0.45 micron pore size membrane filters.

Table C.2. DARK INCUBATION BEGUN NOVEMBER 9, 1972

Unfiltered Runoff Samples

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation		
		Sample Only	Sample + Resin	
		25 Days	25 days	50 days
B-7	576	292	564	641
		293	569	650
		255	595	652
	mean value	280	576	648
F-7	300	140	391	407
		150	396	393
		155	391	386
	mean value	148	393	395
402-8	70	45	107	106
		43	106	113
		44	111	108
	mean value	44	108	109
407-8	27	31	92	107
		32	91	104
		28	92	102
	mean value	30	92	104

Table C.3. DARK INCUBATION BEGUN JANUARY 8, 1973

Unfiltered Runoff Samples

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation			
		Sample Only		Sample + Resin	
		25 days	50 Days	25 Days	50 Days
A-8	354	347	542	372	430
		348	552	389	391
		365	557	401	409
	mean value	353	550	387	410
B-8	410	410	467	455	458
		422	482	476	464
		425	476	470	472
	mean value	419	475	467	465
D-8	328	380	385	381	434
		364	407	399	419
		381	395	391	414
	mean value	375	396	390	422

Table C.4. DARK INCUBATION BEGUN JANUARY 24, 1973

Unfiltered Runoff Samples

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation			
		Sample Only		Sample + Resin	
		25 Days	50 Days	25 Days	50 Days
A-9	868	942	947	930	983
		952	984	957	967
		925	1020	942	961
	mean value	940	984	943	970
B-9	812	867	868	880	853
		846	900	875	869
		865	902	893	906
	mean value	859	890	883	876
F-9	486	545	520	545	562
		530	530	548	545
		537	534	546	561
	mean value	537	528	546	556
D-10	244	320	287	330	342
		300	285	331	343
		304	280	328	341
	mean value	208	284	330	342

Table C.5. DARK INCUBATION BEGUN FEBRUARY 7, 1973

Unfiltered Runoff Samples

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation			
		Sample Only		Sample + Resin	
		13 Days	26 Days	13 Days	26 Days
D-11	252	233	256	286	315
		233	264	288	329
		238	268	276	304
	mean value	235	263	284	316
E-11	30	10	15	35	32
		12	14	39	32
		13	13	36	32
	mean value	12	14	36	32
H-11	110	41	55	106	103
		44	54	100	108
		49	53	102	103
	mean value	44	54	103	105

Table C.6. DARK INCUBATION BEGUN MARCH 8, 1973

Unfiltered Runoff Samples

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation			
		Sample Only		Sample + Resin	
		13 Days	21 Days	13 Days	26 Days
A-12	264	295	293	299	309
		290	305	306	313
		299	309	---	311
	mean value	295	302	302	311
B-12	347	345	394	337	385
		354	406	337	395
		349	397	---	397
	mean value	349	399	337	392
D-12	247	194	249	287	328
		197	257	278	340
		198	250	307	340
	mean value	196	252	291	336
I-12	30	35	84	84	153
		33	84	114	132
		36	82	107	141
	mean value	35	83	102	142

Table C.7. DARK INCUBATION BEGUN DECEMBER 1, 1972

Runoff Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation Sample Only (No Resin) 25 Days	50 Days
402-9	55	67	--
		70	64
		69	66
		71	70
		70	70
	mean value	69	68
409-0	13	30	33
		27	32
		29	32
		28	33
		29	31
	mean value	29	32
404-8	175	205	--
		212	214
		216	225
		214	214
		209	215
	mean value	211	217
409-8	< 1	12	15
		11	18
		13	18
		11	14
		12	12
	mean value	12	15

Table C.8. DARK INCUBATION BEGUN APRIL 13, 1973

Unfiltered River Water Samples

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		14 Days	27 Days	50 Days	14 Days	27 Days	50 Days
No. 31	43	46	35	28	65	45	33
		47	34	24	64	48	32
		47	30	28			
	mean value	47	33	26	64	46	32
No. 32	2	6	0	0	4	1	2
		6	2	0	4	1	2
		6	0	0			
	mean value	6	1	0	4	1	2
No. 33	5	11	3	1	8	2	2
		12	1	0	8	1	3
		14	2	0			
	mean value	12	2	0	8	2	3
No. 34	26	30	26	14	60	57	53
		32	25	19	67	59	54
		32	29	21			
	mean value	31	27	18	63	58	54

Table C.8. (continued)

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		14 Days	27 Days	50 Days	14 Days	27 Days	50 Days
No. 35	47	63	49	37	71	61	61
		66	56	50	74	62	61
		65	62	39			
	mean value	64	56	42	73	62	61
No. 36	7	9	1	1	4	0	2
		10	1	0	2	5	9
		11	3	1			
	mean value	10	2	1	3	3	5

Table C.9. DARK INCUBATION BEGUN MAY 7, 1973

Unfiltered River Water Samples

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation			
		Sample Only		Sample + Resin	
		14 Days	50 Days	14 Days	50 Days
No. 40	6	5	0	29	0
		7	0	11	0
		7	0		
	mean value	6	0	20	0
No. 41	4	6	1	5	4
		5	1	4	4
		4	2		2
	mean value	5	1	4	3
No. 42	40	42	44	38	36
		42	43	40	36
		43	40		36
					32
	mean value	42	42	39	35
No. 43	38	58	61	36	41
		62	68	36	36
		61	70		34
					38
	mean value	60	66	36	37
No. 44	9	5	3	5	9
		7	7	5	4
		7	3		7
					7
	mean value	6	4	5	7

Table C.10. DARK INCUBATION BEGUN MAY 31, 1973

Unfiltered River Water Samples

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation: Sample Only			Sample + Resin		
		13 Days	26 Days	50 Days	13 Days	26 Days	50 Days
No. 49	2	9	8	1	5	4	1
		9	9	0	9	2	0
		14	10	4			
	mean value	12	9	2	7	3	1
No. 50	1	7	5	1	6	0	0
		9	7	0	4	3	0
		8	4	1			
	mean value	8	5	1	5	2	0
No. 51	104	108	102	90	110	105	94
		109	110	111	111	98	93
		109	107	104	110	102	94
	Mean value	109	107	104	110	102	94

Table C.10. (continued)

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		13 Days	26 Days	50 Days	13 Days	26 Days	50 Days
No. 52	50	63	64	58	57	52	41
		63	62	61	53	41	42
		63	64	60			
	mean value	63	63	60	55	46	41
No. 53	5	7	5	1	9	5	12
		7	2	1	8	4	4
		7	5	1			
	mean value	7	4	1	8	4	8

Table C.11. DARK INCUBATION BEGUN JUNE 8, 1973

Unfiltered River Water Samples

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		13 Days	25 Days	50 Days	13 Days	25 Days	50 Days
No. 54	40	49	50	42	49	49	53
		46	49	40	50	52	47
		48	49	43			
	mean value	48	49	42	50	51	50

Table C.12. DARK INCUBATION BEGUN JUNE 22, 1973

Unfiltered River Water Samples

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		13 Days	27 Days	50 Days	13 Days	27 Days	50 Days
No. 56	26	30	28	9	24	29	12
		30	27	13	26	23	11
		30	24	13			
	mean value	30	26	12	25	26	12
No. 57	3	10	5	0	5	8	6
		10	2	0	13	6	6
		11	5	0			
	mean value	10	4	0	9	7	6
No. 58	49	68	70	53	77	75	58
		73	65	54	77	80	56
		72	70	59			
	mean value	71	68	52	77	77	57
No. 59	46	63	66	48	56	58	35
		65	67	51	54	53	31
		72	69	52			
	mean value	67	67	52	55	55	33

Table C.12. (continued)

Sample	Initial DRP (µgP/l)	DRP (µgP/l) after incubation					
		Sample Only			Sample + Resin		
		13 Days	27 Days	50 Days	13 Days	27 Days	50 Days
No. 60	13	21	13	2	20	22	18
		24	19	9	18	22	18
		26	19	4			
	mean value	24	17	5	19	22	18
No. 507-13	5	16	10	9	13	23	23
		16	10	4	16	29	18
		15	10	2			
	mean value	16	10	5	14	26	20

APPENDIX D

Table D.1. CHLOROFORM TREATMENT OF NEW YORK RIVER WATER SAMPLES

Initial Data, Before Chloroform Treatment				DRP* in Chloroform - treated samples after:		
Sample No.	Initial DRP (µgP/l)	Initial TSP (µgP/l)	TP (µgP/l)	1 Day	7 Days	14 Days
27	4	8	18	9	10	10
				8	8	4
				9	11	10
			mean value	9	10	8[c]
28	68	71	93	66	44	31
				71	61	31
				71	74	77
			mean value	69	63	46[c]
29	78	82	106	78	80	83
				81	84	88
				81	83	88
			mean value	80	82	86[a]
31	43	49	95	44	47	
				47	50	
				47	51	
			mean value	46	49[b]	
33	5	10	34	10	14	
				11	15	
				11	14	
			mean value	11	14	

[a] 15 days [b] 9 days [c] 16 days * Each value represents one test flask

Table D.1. (continued)

Initial Data, Before Chloroform Treatment				DRP in Chloroform - treated samples after:		
Sample No.	Initial DRP (µgP/l)	Initial TSP (µgP/l)	TP (µgP/l)	1 Day	7 Days	14 Days
34	26	26	386	32	36	
				32	37	
				32	36	
			mean value	32	36[b]	
35	47	52	105	60	65	
				63	70	
				62	67	
			mean value	62	67[b]	
36	7	12	34	10	14	
				11	15	
				11	15	
			mean value	11	15[b]	
49	2	6	51	14	24	28
				13	19	22
				14	22	22
			mean value	14	22	24
50	1	7	26	10	17	20
				12	16	18
				13	16	18
			mean value	12	16	19

[b] 9 days

Table D.1. (continued)

Initial Data, Before Chloroform Treatment				DRP in Chloroform - treated samples after:		
Sample No.	Initial DRP (µgP/l)	Initial TSP (µgP/l)	TP (µgP/l)	1 Day	7 Days	14 Days
51	104	111	173	107	119	117
				113	123	125
				114	124	122
		mean value		111	122	122
52	50	57	104	59	69	69
				62	71	75
				61	70	73
		mean value		61	70	72
53	5	16	41	15	21	24
				15	19	25
				15	11	15
		mean value		15	17	21
54	40	51	87	48	55	56
				49	58	59
				49	58	59
		mean value		49	57	58
56	26	33	59	26	29	30
				27	7	21
				28	30	31
		mean value		27	22[d]	31

[d] 8 days

Table D.1. (continued)

Initial Data, Before Chloroform Treatment				DRP in Chloroform - treated samples after:		
Sample No.	Initial DRP (µgP/l)	Initial TSP (µgP/l)	TP (µgP/l)	1 Day	8 Days	14 Days
57	3	7	86	15	18	21
				17	18	21
				18	23	25
		mean value		17	20	22
58	49	58	204	62	75	74
				65	76	80
				62	76	78
		mean value		63	76	77
59	46	59	147	77	86	103
				77	90	93
				77	27	78
		mean value		77	68	91
60	13	24	99	25	9	32
				29	35	40
				28	39	37
		mean value		28	28	37

Table D.1. CHLOROFORM TREATMENT OF NEW YORK RIVER WATERS

Begun May 8, 1973 and August 13, 1973

A. Initial Data, before Chloroform treatment

Sample No.	Initial DRP (µgP/l)	Initial TSP (µgP/l)	TP (µgP/l)
40 Niagara R. (Beaver I.)	6	10	15
41 Niagara R. (Ft. Niagara)	4	8	22
42 Genesee R.	40	45	150
43 Oswego R.	38	46	96
44 Black R.	9	15	34

B. Storage of Samples without Chloroform at 4°C for 96 days (begun May 8, 1973)

Sample No.	DRP (µgP/l) Initial	DRP (µgP/l) After Storage*	DRP after storage (percent of TP)
40	6	7	
		7	
	mean value	7	47
41	4	16	
		16	
	mean value	16	73
42	40	40	
		40	
	mean value	40	27
43	38	69	
		69	
	mean value	69	72
44	9	9	
		9	
	mean value	9	26

*replicate samples from cubitainer used for cold storage of bulk sample

Table D.1. (continued)

C. Chloroform Test at 20°C (begun August 13, 1973)

Sample No.	DRP in Chloroform-Treated Samples 1 Day	7 Days	14 Days	DRP at 14 Days (Percent of TP)
40	9	17	10	
	10	10	10	
	10	11	10	
	10	11	10	
mean value	10	12	10	67
41	17	19	18	
	17	19	18	
	19	20	22	
	19	20	18	
mean value	19	20	19	86
42	43	48	50	
	46	51	52	
	44	50	52	
	46	50	50	
mean value	44	50	51	34
43	71	71	73	
	72	75	75	
	74	76	77	
	74	75	78	
mean value	73	74	76	79
44	11	16	17	
	11	16	17	
	11	16	17	
	11	16	18	
mean value	11	16	17	50